PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
G03F 7/20, 9/00, G03B 27/10, 27/16, B41C 1/10

A1

(11) International Publication Number: **WO 96/35144**

(43) International Publication Date: 7 November 1996 (07.11.96)

(21) International Application Number: PCT/SE96/00564

(22) International Filing Date: 30 April 1996 (30.04.96)

(30) Priority Data:
9501637-4 3 May 1995 (03.05.95) SE

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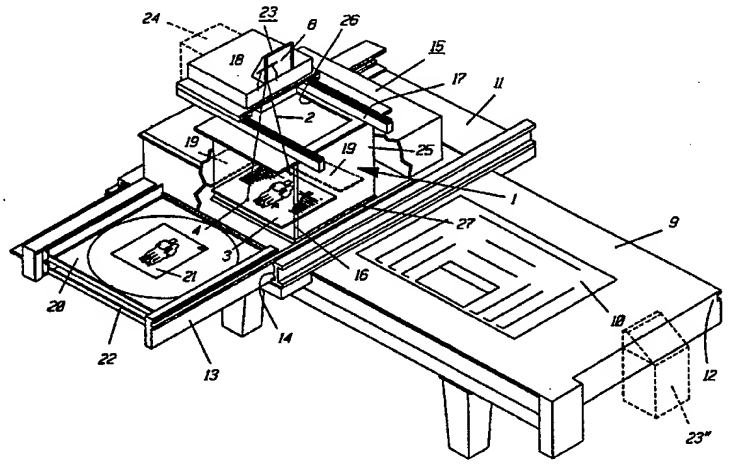
(81) Designated States: DE, GB, JP, US.

Published
With international search report.
With amended claims.

(54) Title: COPY PRINT MACHINE HAVING A FIXEDLY ADJUSTABLE LASER UNIT



(57) Abstract

Copy print machine for making exposures by means of laser light on films or plates (3), in particular on films and printing plates for the graphic industry, like offset plates, and comprising a copying table (9) on which printing plates (3) can be placed in predetermined positions, a lower carriage (11) which is displaceable on the copying table (9), an upper carriage (13) which is displaceable on the lower carriage (11) perpendicularly to the displacement direction of said lower carriage (11), and a light house (15) which is mounted on the upper carriage (13), and in which the light housecarries a laser housing (18) having a laser light unit (23) which is arranged for being raised and lowered in the light house (15), and which in its lowered position, in which position exposure is made of the film or plate (3), is adapted to be blocked in a extremely exact vertical position in relation to the film or the printing plate (3) using a light box (25) having a bottom edge (27) arranged for being pressed into contact with the printing plate (3) during the exposure thereof.

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COPY PRINT MACHINE HAVING A FIXEDLY ADJUSTABLE LASER UNIT

The present invention relates to a copy print machine of the type which is intended to be used for exposure of films or plates, in particular printing plates for the graphic industry, like offset plates. The invention is more particularly concerned with such a copy print machine in which the exposure, in the first place, is made by means of laser light, or eventually by means of some other type of modulated light, but in which the exposure preferably also can be made, in one and the same copy print machine, both by means of laser light and some other type of modulated light and by means of conventional bulb light, that is both by a digital and by an analogous exposure.

Modern pre-covered printing plates, like offset plates on the market to-day have such high light sensitivity that it is possible to expose the printing plate by means of laser light, generally based on information received directly from a computer, which information can supply both text and pictures. In many cases there is, however, film set-ups are still often used for exposure of the printing plate, and therefore it would be good if the copy print machine alternatingly could be used both for laser copying and for copy printing of film set-ups by means of conventional bulb light. The film set-ups may contain advertising material etc., which is generally supplied to several different printing shops for being used in various newspapers, magazines and other printed matter.

In connection to exposing of printing plates by means of laser light some problems appear which are difficult to overcome. One problem emanates from the fact that the laser light beam, after having passes a lens system, gets a very narrow depth of sharpness. It is generally meant that the focal distance for a laser dot to a film or printing plate should not be allowed to vary by more than 50 μm (50/1000 mm) at a maximum, since otherwise the screen dot will appear unsharp and this gives an impaired printing result.

In any and all laser copying processes a laser light beam from a fixedly, or sometimes movably mounted laser light source, often referred to as a laser gun, is allowed to sweep over the surface of the film or the printing plate thereby transmitting text and/or images from a computer to said film or light sensitive plate. Thereby three problems appear, which are independent of each other, namely a) the problem that the focal point of the laser light beam does not fall exactly on the plate surface over the entire sweeping width,

b) the problem that the laser points get different appearance over the length of the sweeping movement, and c) the problem that the parts of the apparatus may vibrate slightly in relation to each other which gives rise to shaking unsharpness of the printed laser dots:

a) The shortest distance of the laser light beam from the laser apparatus to the film or printing plate is perpendicularly to said film or plate and said distance necessarily grows longer following the angular deflection of the laser beam from the focal point of said central laser beam. If the laser light point is set to be sharp for the central laser beam the sharpness of said laser beam will imaginary fall above the plate aside of said central laser beam, and it will fall successively higher following the deflection of the laser beam from the centre of the sweeping light movement. In order to compensate, as far as possible, for such lack of sharpness of the light rays aside of the central light ray it has be usual to adjust the laser apparatus so that the central laser light rays have their best sharpness slightly underneath (imaginary) the film or plate, whereas the outermost side rays present their best sharpness (imaginary) slightly above the film or plate, meaning that the laser light apparatus is adjusted so as to give a mean value sharpness of the light beam for its entire sweeping movement.

b) Consequently it is not possible to provide a complete sharpness at all parts of the film or plate during the laser exposure, and in addition thereto the laser dots get different shape over the sweeping distance, namely a circular shape at the central light rays and a successively more elliptically extended shape the longer distance there is from the central laser light ray. Also said difference in appearance contributes to impairing the quality of the exposure.

c) In order to reduce the differences in focal lengths and the differences in point shape over the sweeping distance of the laser light beam some laser copying machines are formed so that the laser apparatus is mounted on a relatively long distance from the film or plate to be exposed, and thereby it has been possible to restrict the sweeping angle to 20-30°. Such angle has been considered a sweeping range which gives acceptable differences in focal distances and differences in shape of the laser dot. The long distance between the laser apparatus and the printing plate, however, involves a risque that there appear relative movements between laser apparatus and the printing plate, and even the slightest vibration or relative

movement irrevocably leads to a significant shaking unsharpness of the laser dot depending on the long distance between the laser apparatus and the printing place. Of course, the risque of shaking unsharpness is greater the longer distance there is between the laser apparatus and the printing plate.

Attempts have been made to reduce at least the above mentioned problem with the varying shape of the laser dot over the sweeping distance thereof by placing the laser light source or the "laser gun" relatively close to the printing plate and by mounting a type of correction lens, for instance a lens of the type which is generally referred to as a "banana lens" between the laser gun and the printing plate. Such a banana lens deflect the laser light rays so that all rays, if ever possible, fall at right angle the printing plate. Such an apparatus is shown for instance in the U.S. patent nr US 4,821,048 and the German patent DOS 27 25 308.

By such arrangements the differences in dot shape over the sweeping length of the laser beam can be reduced to some extent, but still there remains the problem that the best sharpness of the laser dots (imaginary) fall above or underneath the printing plate at differences places of the sweeping path depending on the above mentioned "mean value adjustment" of the focal distance. The apparatus having a banana lens also is expensive, and it makes it difficult or even impossible to alternatingly make copies by means of laser light and by means of convention bulb light in one and the same copying machine, that is a mixed exposure of text and pictures directly from the computer and exposure from available film set-ups.

In applicant's own patent publication WO 92/21517 is suggested that the laser apparatus be placed relatively close to the printing plate, and that the printing plate be exposed in several successive stages in that only a minor portion of the printing plate is being exposed at the time, and that the laser apparatus is moved stepwise between each place of part exposure of the printing plate. Since there are no obstacle lens systems in the said known apparatus it may be possible to make a mixed exposure by means of laser light and by means of conventional bulb light, respectively.

Problems may, however, appear also with the apparatus of said last mentioned patent publication in that the focal point of the laser light dot does not fall exactly on the printing plate. For making it possible to move the laser unit in connection to the stepwise exposure of the printing plate, and for making it possible to introduce a printing plate into the exposure position and

to remove the printing plate therefrom it is necessary that the laser unit, or at least some parts thereof, can be raised and lowered. This creates difficulties to adjust the focal point of the laser unit to the necessary very exact difference in location of ±50 μm in relation to the printing plate. It may also be that the copying table, on which the printing plate lies during the exposure, can be slightly uneven, and that the unevenesses exceed the maximum distance of the for instance ±50 μm which is necessary for the laser exposure to take place with satisfactory sharpness. It may also happen that the printing plate itself is slightly uneven, or that the printing plate is not in completely tight contact with the copying table.

Also, even very insignificant vibrations may appear between the laser unit and the printing plate, which vibrations impair the exposure result. Such vibrations may easily appear for the reason that it is necessary that the laser unit can be raised and lowered, and that it is necessary that the laser unit can be displaced during the stepwise exposure of the printing plate.

The basis of the invention therefore has been the problem to provide a copy print machine for stepwise laser copying of films and printing plates etc. for the graphic industry, which machine gives an optimum sharp laser copying dot over the entire copying area, which is formed so that the risk of vibrations between the laser unit and the printing plate has been practically eliminated, and which is formed so that the laser unit is pressed into butt contact with the printing plate during the exposure process and so that the printing plate at the same time is pressed into intimate contact with the copying table. The copying machine preferably also is formed so as to allow a mixed copying in one and the same machine by means of laser light and by means of conventional bulb light.

Now the invention is to be described more i detail with reference to the accompanying drawings. In the drawings figure 1 diagrammatically illustrates the problem with the variations in shape of the laser dot, and figure 2 similarly illustrates the problem that the laser focus points are placed differently in relation to the surface of the copy plate. Figure 3 shows an example of a prior art apparatus intended to solve the described problems in connection to laser copying processes. Figure 4 diagrammatically illustrates the method of making laser copy printing according to the invention. Figure 5 is a perspective view of a laser copying machine formed in accordance with the invention, in a partly cut open condition. Figure 6 shows a first

embodiment or a light box including a laser unit used in the copying machine of figure 5, and figure 7 shows an alternative embodiment of the the light box with the laser unit. Figure 8 is a vertical cross section view along lines VIII-VIII through the light box of figure 6, and figure 9 diagrammatically and in an enlarged scale shows the lower part of the light box of figure 8. Figure 10 is a perspective part view of a bearing means for the laser unit on the light box, and figure 11 shows an air bearing body used in the bearing means of figure 10.

In figure 1 is illustrated how a laser exposure unit 1 emits laser exposure rays 2 towards a material 3 having a light sensitive layer, for instance a film or a printing plate. It is shown that the laser light rays 2a, which fall substantially perpendicularly onto the plate 3, get a small circular exposure point, whereas the angularly deflected rays 2b, which meet the plate 3 under an acute angle on each side of the central ray 2a, get the shape of an ellipse having a major axis which grows successively increased following the distance from the central rays 2a. The laser dots are shown in an enlarged and exaggerated scale following the dotted arrows in the drawing.

Figure 2 correspondingly shows a laser apparatus 1 which is mounted so that the focal points 4a of the central laser rays 2a imaginary fall underneath the plate 3, whereas the sharp focal points 4b of the outer laser rays 2b imaginary fall above the plate 3. Only at two places between the central and the outer laser rays the focal points fall exactly on the surface of the printing plate 3. In the drawing is indicated that the distance between the focal points should not be allowed to exceed 50 μm at a maximum in order not to present a not allowable unsharpness. For this reason the laser beam should not be allowed to deflect too far, and the deflection angle preferably should not exceed ±10°.

Figure 3 shows a priorly known apparatus, for which attempts have been made to solve the problems which are illustrated in figures 1 and 2 by using a correction lens, a so called "banana lens" 5. As discussed above said apparatus, however, involves some problems and disadvantages.

As diagrammatically indicated in figure 4, the copy print machine according to the invention is formed so as to provide a stepwise exposure of the printing plate 3 threby printing small parts of the plate at the time. By this measurement the laser unit can be mounted substantially closer to the

printing plate 3 than has been possible in many known laser copy print machines. As known the laser unit comprises a laser light source 6 which over a first lens system 7a emits a laser light ray towards a rotating, obliquely mounted deflection prism, a so called hologone 8, which deflects the laser light ray and creates the sweeping movement thereof, and in which the laser light ray, over a second lens system 7b directs a sharp point towards the printing plate 3, whereby text and pictures (images) are being laser exposure printed onto the light sensitive layer of the plate. Alternatively the laser light can be projected to the printing plate by reflection, by opto-acoustic modulation or any other deflection of the light. It is indicated in the figure that the exposure is made step by step, for instance in 4-8 successive steps per printing plate. Between each exposure step the laser unit is moved in one direction or two directions perpendicularly to each other, as indicated with arrows at the top of figure 4.

Figure 5 shows a complete copying machine arranged in accordance with the invention, in a partly cut open condition. The copying machine is built up on a copying table 9, on which one or more unexposed printing plates 10 are placed in a predetermined position, generally an accurately defined position provided by (not illustrated) register pins. A lower carriage 11 is displaceable in the longitudinal direction of the table 9, guided in prism bars or guides 12 provided along the edges of the table. The lower carriage 11, in turn, carries an upper carriage 13 which is correspondingly displaceable on guides 14 perpendicularly to the displacement direction of the lower carriage 11. A light house 15 comprising a laser light unit 1 is mounted on the upper carriage 13. The laser unit 1 is arranged for being raised and lowered in the light box, guided by vertical guides 16 which are only indicated diagrammatically in the drawing.

The upper side of the light house is formed with guide rails 17 on which a laser housing 18 is displaceable, in the illustrated case in the longitudinal direction of the copying table 9. It is necessary that the laser housing 18 can be displaced thereby providing a displacement of the laser beam over the exposure surface of the printing plate. The laser unit 1 preferably also can be slightly displaced perpendicularly to the guide rails 17 for slight corrections of the positioning of the laser unit, as shown in figures 10 and 11.

Several displaceable masks 19 can be mounted in the light house15,

for instance at a place close to the bottom thereof, or possibly in the laser housing, which masks are only indicated diagrammatically in figure 5. The purpose of said masks is to screen off those parts of the printing plate 3 which are to be left unexposed during an actual part exposure of the printing plate 3 by means of ordinary bulb light.

The copying machine operates so that the lower carriage 11 with all parts mounted thereon is moved from the exposure position shown in figure 5 to a position above the unexposed plates 10 which are placed in correct positions on the table; a plate is picked up by means of a vacuum sucking means; the lower carriage 11 with the plate 10 is retracted; and the plate 10 is let down and is suction connected in a predetermined position on the copying table, that is the position which is shown with the printing plate 3 in figure 5. The printing plate is thereafter exposed step by step with a little portion thereof at the time. The exposure is made by means of the laser unit 1 while the laser housing 18 is displaced on its guides 17 and the laser beam executes its sweeping or reciprocating movement. It has proved that the swinging movement of the laser beam should not exceed an angle of ±10° from the vertical laser light ray for giving a good result.

In order to make it possible to handle also film originals (set-ups) the copying machine is formed with an upper film magazine 20 for not yet exposed films 21 and a lower magazine 22 for exposed films. Said magazines operate alternatingly for introducing a film 21 in a position above the printing plate 3 and for removing a used film, respectively, and placing same in the lower magazine 22. The exposing of the film originals is made in that the masks 19 are set so as to screen off those parts of the printing plate which are not to be exposed, and in that exposure is made by means of bulb light or another not modulated light.

For exposure of the printing plate 3 by means of laser light a laser light unit 23 of known type is mounted in the laser housing 18, and for exposure of film originals 21 a light bulb is mounted in a bulb housing 24, which can be mounted inside the light house15 or aside of the laser housing 18.

It is very important that the laser light unit 23 is mounted and arranged so that the focal distance of the laser beam during the exposure is very accurately defined in relation to the printing plate 3 on the copying table, and according to the invention the vital parts of the laser light unit therefore are mounted in a light box 25 which can be raised and lowered, and which is

guided in the above mentioned diagrammatically indicated vertical guides 16 of the light house15.

It is necessary that the light house15 can be raised and lowered while printing plates 10 are picked up and are returned and while film set ups 21 are picked up and returned. Before the exposure process starts the light box 25 is lowered into butt contact with the printing plate 10 and the bottom edge thereof will thereby define a very accurately determined position for the box against the printing plate, and therefore the differences in focal distances for the laser light rays can very well, with the said pendulum angle of ±10°, be kept under the critical limit of 50 μm, in many cases even less differences.

In figure 6 the laser light box 25 is shown more in detail. It is shown that the laser housing 18 contains a laser light source 6 which over mirrors and lens systems 7 directs the laser beam towards a hologone 8 which reflects the light beam down towards the printing plate 3 on the copying table. During displacements of the lower carriage 11 the light box 25 with all supplies mounted thereon is kept slightly raised, for instance while picking up and introducing an unexposed printing plate 10 into exposure position and while returning an exposed printing plate. When starting the exposure process the light box 25 is lowered into contact with the printing plate 3 whereby the laser light is switched on. The contact between the light box 25 and the printing plate 3 can be established in that the box, depending on its own weight, is pressed into contact with the printing plate, or it can be positively pressed into contact with the printing plate, or it can be sucked into contact with the printing plate by means of vacuum. Since the light box 25 is pressed to the printing plate 3 on the copying table 9 there is obtained a butt contact both between the laser light unit 23 with the light box 25 and the printing plate 3 and also between the printing plate 3 and the copying table 9, and thereby it is obtained an equalization of all unevenesses and a very accurate adjustment is thereby obtained of the laser unit 23 in relation to the printing plate 3.

During the copying process the laser housing 18 is displaced on its guides 17 in a very stable movement. After a first part of the printing plate has been exposed the lower carriage 11 or the upper carriage 13, or both, is/are moved to a new position of adjustment for the laser unit and the next part of the printing plate 3 is exposed in the same way as mentioned above.

For making it possible to handle also film originals (film set-ups) 21 a

bulb housing 24 is mounted on or inside the laser housing 18. When exposing film set-ups 21 the laser housing 18 is moved so far in one direction or the other that the bulb housing 24 is positioned over a light shaft 26 in the light box 25.

Figure 7 shows an alternative embodiment of the exposure light unit. In this case the laser gun of the laser light unit 23' is mounted against one side of the light box 25. Otherwise the exposure light unit is similar to that shown in figure 6. All embodiments of the light box are formed with all around extending sides and with a bottom edge 27 which is arranged to be pressed or sucked into contact with the printing plate 3 on the copying table. The light box 25 has a length and a width which only slightly exceeds the maximum pendulum width (2b ↔ 2b) for the laser light beam.

When making exposures by means of laser light it is important that the laser light unit 23 is stably mounted in relation to the printing plate 3 lying on the copying table 9 so that there cannot be any shaking unsharpness and so that the laser light rays with exact sharpness (with the mean value approximation discussed in connection to figure 2) fall exactly on the surface of the printing plate. Since the lower carriage 11, the upper carriage 13 and the light box 15 are movable with extreme accuracy in their guides 12, 14 and 17 the integral unit can be considered so stable that the laser gun may even be mounted directly against an edge of the copying table as indicated by 23" in figure 5, or anywhere on top of the copying table.

As mentioned above the laser housing 18 can be movably mounted on the light box 25, so that minor adjustments can be made of the position of the laser unit, preferably with a tolerance of ± 1%. To this end the top of the light box 25 can be formed with rails extending perpendicularly to the light housing rails 17, and on which the laser unit 1 can be moved. In order to provide an extreme accuracy in said transverse adjustment movement of the laser unit the rails preferably are granite prisms 28 which are extremely insensitive to heat changes. The laser unit is formed with several air bearings 29 engaging both the sides of the granite prisms 28 and the top thereof. The air bearing 29 can be in the form of circular granite discs 30 a flat surface of which is facing the granite prism 28, and having an axial bore 31 through which air is blown, whereby an extremely this layer of air carries the laser unit on the granite prims 28 and thereby on the laser housing 18. As shown in figure 10 the laser unit is formed with a U-shaped slide 32 on one side

thereof having 2 + 2 + 2 air bearings 29 engaging the sides and the top of the granite prism. On the other side the laer unit is formed with projecting arm 33 having an air bearing 29 engaging the top of the corresponding granite prism.

REFERENCE NUMERALS

1	laser unit	18	laser housing
2	laser light rays (2a, 2b)	19	mask
3	printing plate	20	upper film magazine
4	focal point (4a, 4b)	21	film
5	banana prism (prior art)	22	lower film magazine
6	laser light source (laser gun)	23	laser light unit
7	lens system (7a, 7b)	24	bulb housing
8	hologone	25	light box
9	copying table	26	light shaft
10	printing plate (unexposed)	27	bottom edge
11	lower carriage	28	granite prisms
12	guide	29	air bearing
13	upper carriage	30	granite disc
14	guide	31	bore
15	light box	32	slide
16	vertical guide	33	arm
17	guide rail		

CLAIMS

1. Copy print machine for making exposures by means of laser light or another type of modulated light on films or plates (3), in particular on films and printing plates for the graphic industry, and comprising a copying table (9) on which printing plates (3) can be placed in predetermined positions, a lower carriage (11) which is displaceable on the copying table (9), an upper carriage (13) which is displaceable on the lower carriage (11) perpendicularly to the displacement direction of said lower carriage (11), and a light house(15) which is mounted on the upper carriage (13), **characterized** in that the light house carries a laser housing (18) having a laser light unit (23) which is arranged for being raised and lowered in the light house(15), and which in its lowered position, in which position exposure is made of the film or plate (3), is adapted to be blocked in an extremely exact vertical position in relation to the film or the printing plate (3).

2. Copy print machine according to claim 1, **characterized** in that the laser housing(18) is mounted on a light box (25) having box sides and bottom edges (27) and having a light shaft (26), and which, in connection to the exposure process, is adapted to be press connected or suction connected, with the bottom edges (27) of the light box, into butt contact with the film or plate (3) to be exposed.

3. Copy print machine according to claim 1 or 2, **characterized** in that the laser housing (18) is displaceable on guide rails (17) on top of the light house(15).

4. Copy print machine according to claim 2 or 3, **characterized** in that the height of the light box (25) having a laser hologone (8) mounted thereon corresponds, with very high accuracy, to the mean focal distance for the laser light beam (2a, 2b).

5. Copy print machine according to any of the preceding claims, **characterized** in that the laser unit (23) is arranged to give the laser light rays a pendulum movement (2a $\leftrightarrow$ 2b) of about $\pm 10°$ from a central laser light ray meeting the film or plate (3) under right angle.

6. Copy print machine according to any of the preceding claims, **characterized** in that the differences in height between the central laser light ray (2a) and the outwardly deflected laser light rays (2b) is 50 μm at a maximum.

7. Copy print machine according to any of the preceding claims, **characterized** in that the machine is designed for alternatingly digital exposure by means of laser light (18) and exposure of available film set-ups (21) by means of bulb light, whereby the light house(15) to this end carries both a laser light housing (18) and a bulb light housing (24).

8. Copy print machine according to claim 7, **characterized** in that the bulb light housing (24) is mounted inside the laser housing (18) or aside thereof, and in that the bulb light housing (24) can be moved to exposure position by displacing the laser housing (18) on its guides (17).

9. Copy print machine according to claim 1, **characterized** in that the laser light unit (23) is mounted slightly adjustable in a direction perpendicular to the guide rails (17) of the laser housing (18).

10. Copy print machine according to claim 9, **characterized** in that the laser light unit (23) is movable on granite prisms (28) over a series of horizontally and vertically acting air bearings, for instance in the form of cylindrical discs (30) having an axial bore (31) through which air is pressed to form an air cushion against the granite prisms (28) on which air cushion the laser light unit (23) is slidable.

AMENDED CLAIMS

[received by the International Bureau on 30 September 1996 (30.09.96); original claims 1-10 replaced by amended claims 1-8 (2 pages)]

1. A copy print machine for making exposures by means of laser light or another type of modulated light on films or plates (3), in particular on films and printing plates for the graphic industry, and comprising a copying table (9) on which printing plates (3) can be placed in predetermined positions, a lower carriage (11) which is displaceable on the copying table (9), an upper carriage (13) which is displaceable on the lower carriage (11) perpendicularly to the displacement direction of said lower carriage (11), and a light house (15) which is mounted on the upper carriage (13), and which is displaceable in a direction which is perpendicular to the sweeping direction of the laser light beam, and which carries a laser housing (18) having a laser light unit (23) which is mounted so that it can be raised and lowered, **characterized** in

that the laser housing (18) is mounted on a light box (25) having sides and bottom edges (27) being formed with a light shaft (26), which laser housing (18) is arranged for being pressed and suction connected by a butt contact with the bottom edges thereof onto a film or a printing plate (3) to be exposed lying on the copying table (9),

and in that the height of the light box (25) having a laser hologone (8) mounted thereon is such that the distance between the focusing lens of the optical system and the film or printing plate (3) lying on the copying table (9) very accurately corresponds to the average focal distance for a laser light beam (2a, 2b) sweeping over the film or the printing plate (3).

2. A copy print machine according to claim 1, **characterized** in that the laser unit (23) is arranged to give the laser light rays a pendulum movement (sweeping range 2a ↔ 2b) of about ±10° from a central laser light ray (2a) meeting the film or plate (3) under right angle.

3. A copy print machine according to claims 1 and 2, **characterized** in that the differences in height between the focal point of a laser light ray (2a) meeting the printing plate under right angle and the maximum outwardly deflected laser light rays (2b) is 50 μm at a maximum.

4. A copy print machine according to claim 1, 2 or 3, **characterized** in that the laser housing (18) is displaceable on guide rails (17) on top of the light house(15).

5. A copy print machine according to any of the preceding claims, **characterized** in that the machine is designed for alternatingly performing

digital exposure by means of laser light (18) and exposure of available film set-ups (21) by means of bulb light, whereby the light house(15) to this end carries both a laser light housing (18) and a bulb light housing (24).

6. A copy print machine according to claim 4 or 5, **characterized** in that the bulb light housing (24) is mounted inside the laser housing (18) or aside thereof, and in that the bulb light housing (24) can be moved to exposure position by displacing the laser housing (18) on its guides (17).

7. A copy print machine according to claim 1, **characterized** in that the laser light unit (23) is mounted slightly adjustable in a direction perpendicular to the guide rails (17) of the laser housing (18).

8. A copy print machine according to claim 7, **characterized** in that the laser light unit (23) is movable on granite prisms (28) over a series of horizontally and vertically acting air bearings, for instance in the form of cylindrical discs (30) having an axial bore (31) through which air is pressed to form an air cushion against the granite prisms (28) on which air cushion the laser light unit (23) is sliceable.

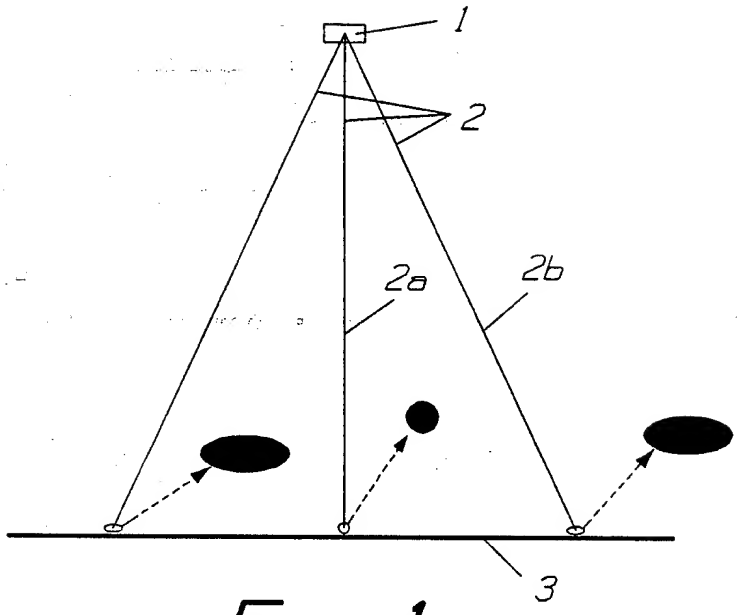

Fig. 1

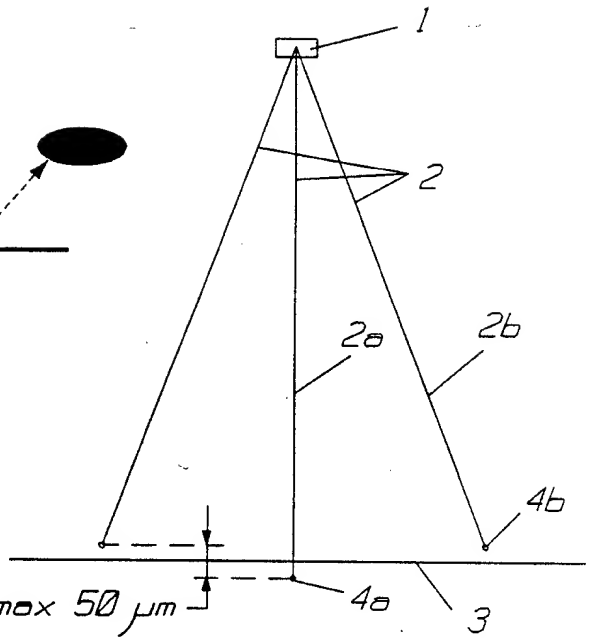

Fig. 2

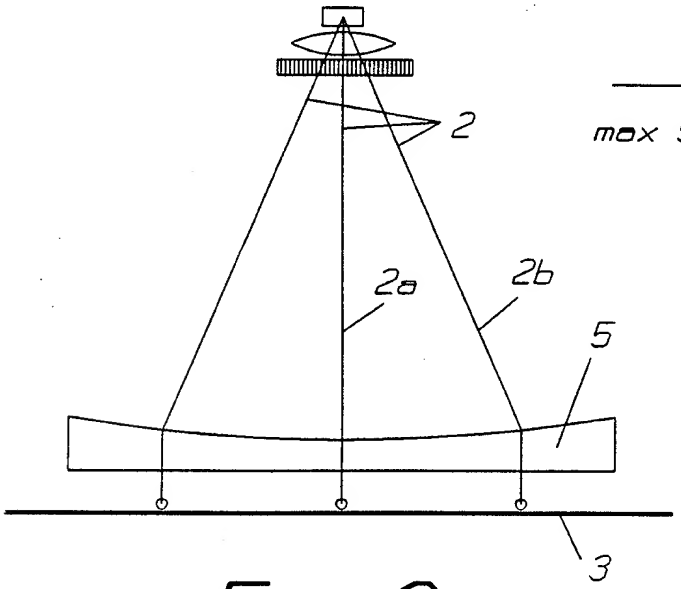

Fig. 3
(Prior Art)

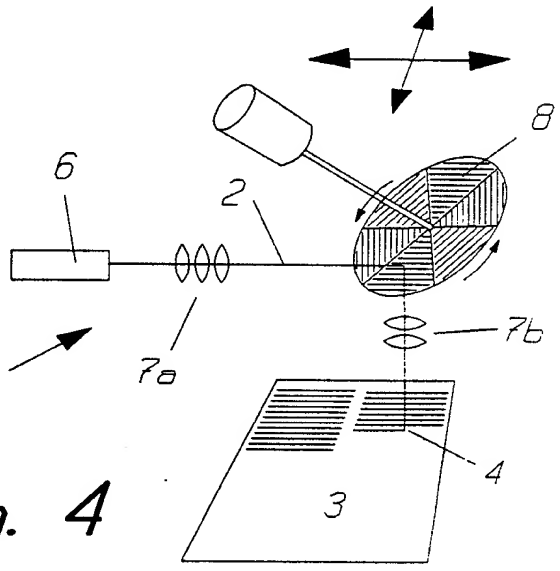

Fig. 4

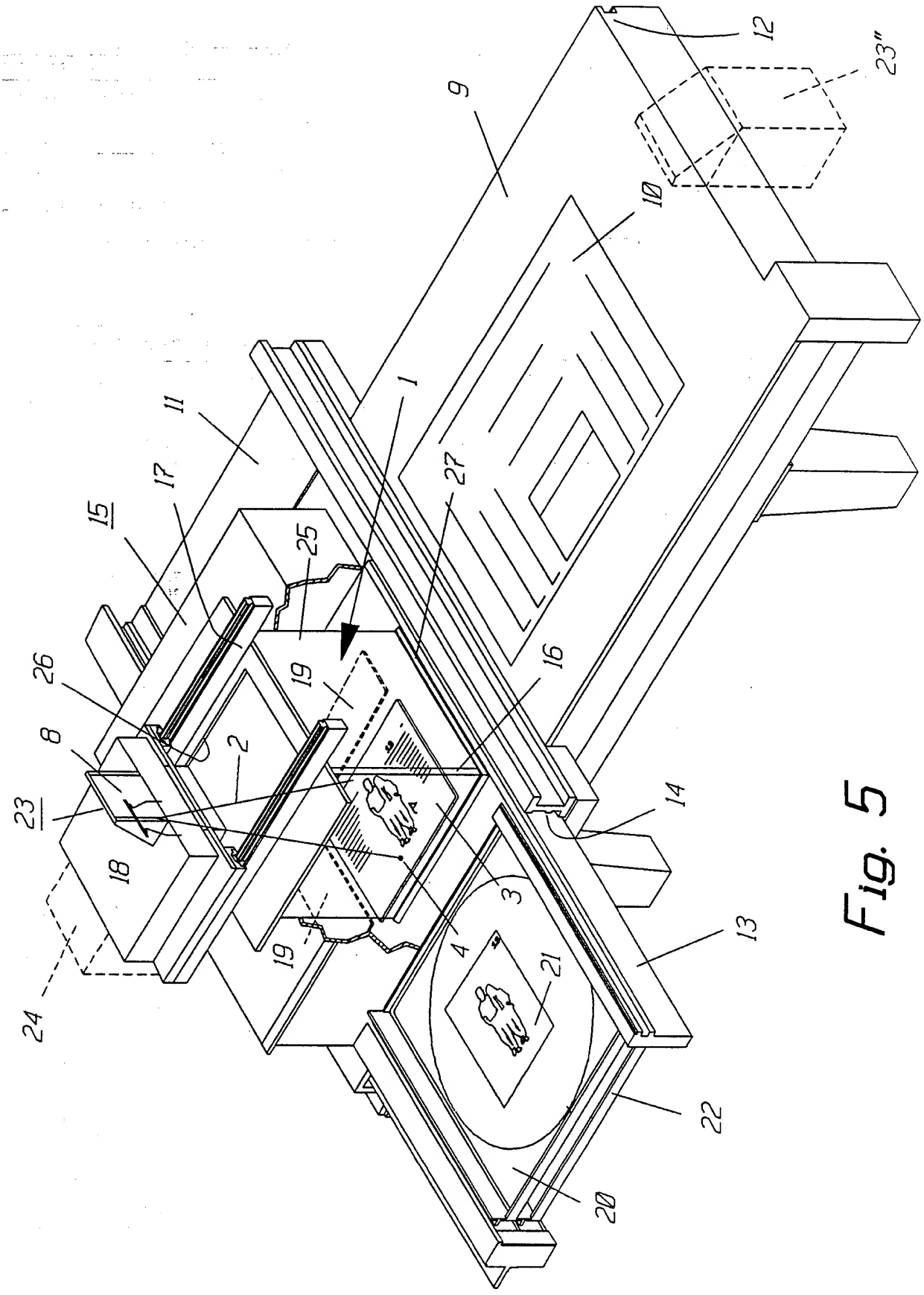

Fig. 5

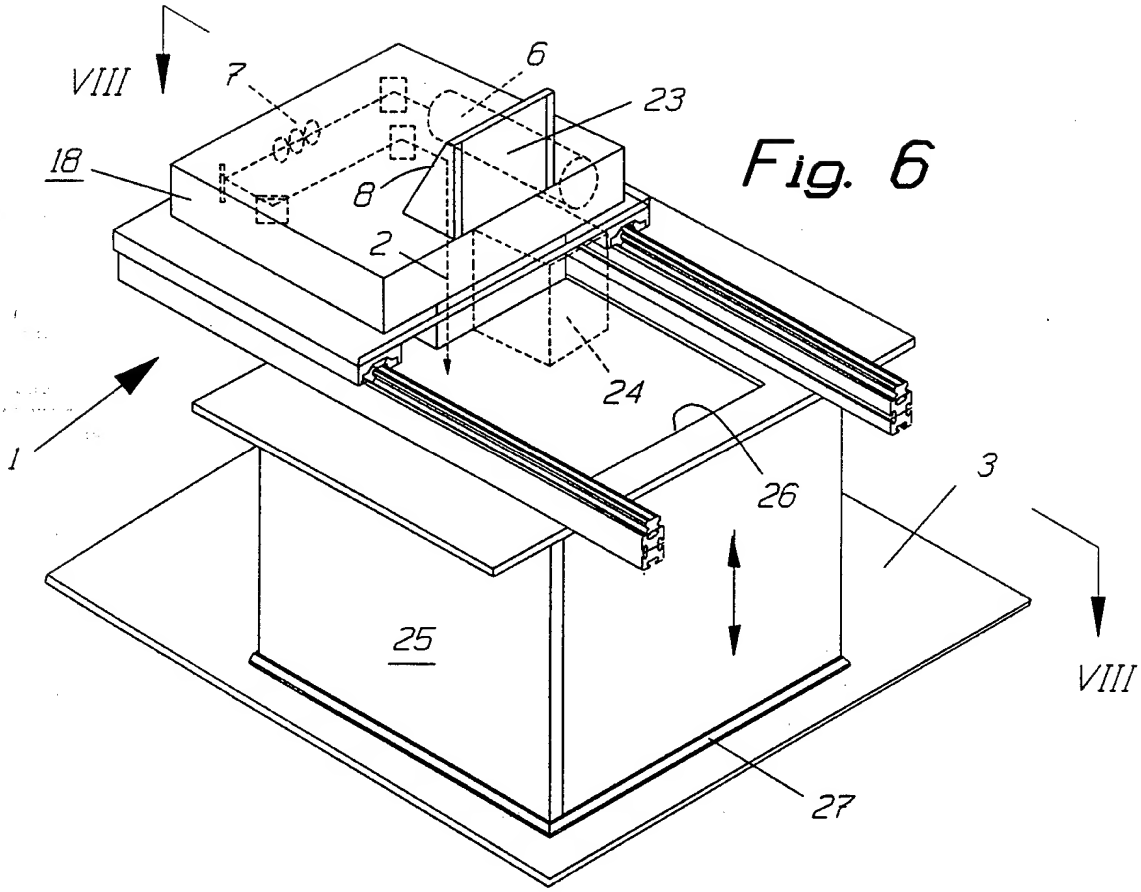

Fig. 6

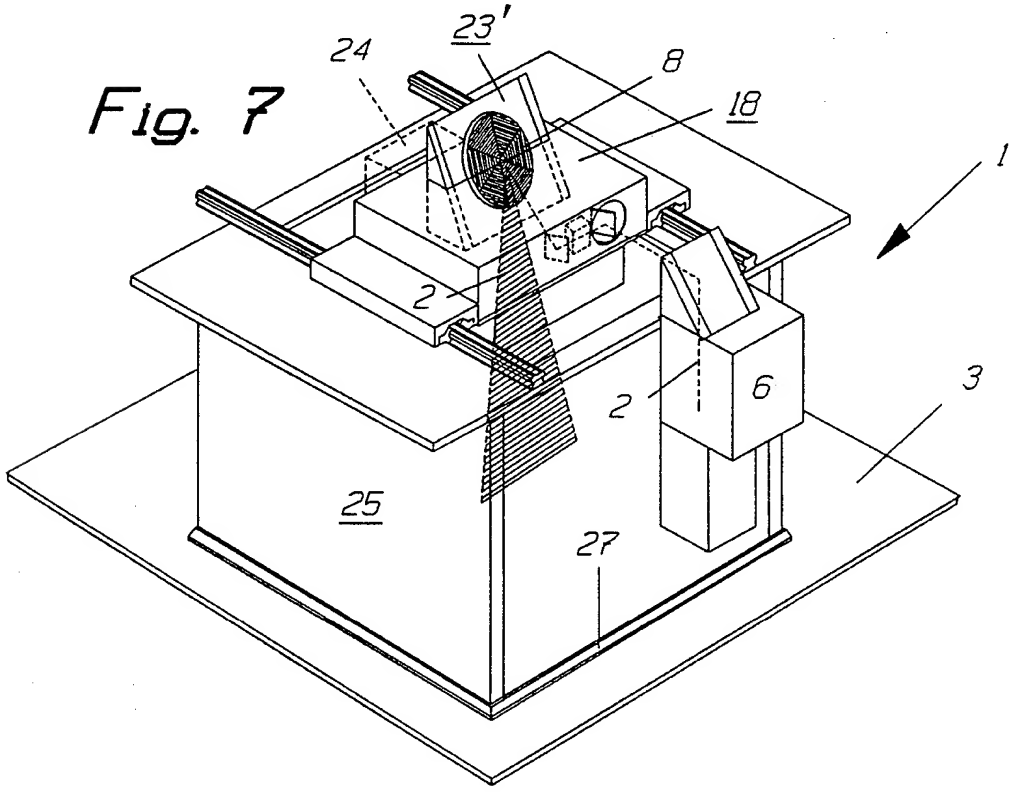

Fig. 7

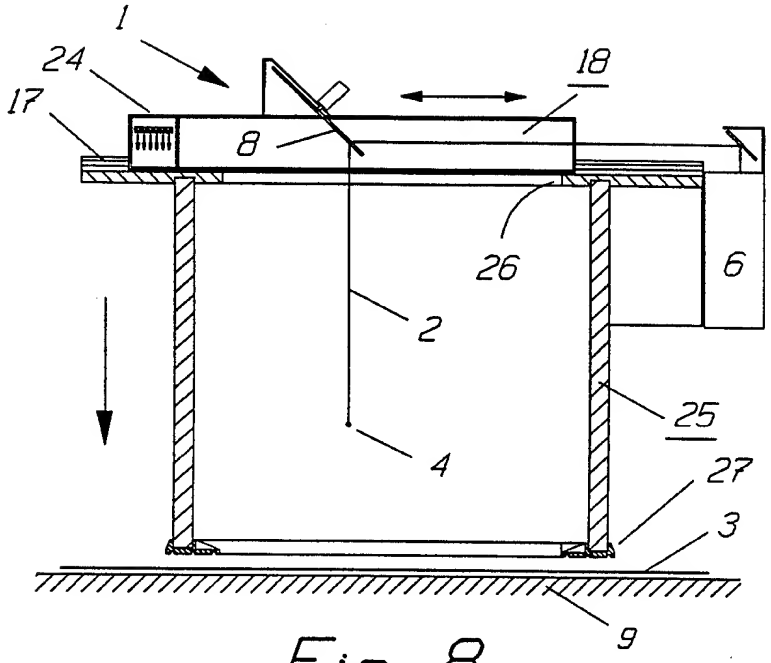

Fig. 8

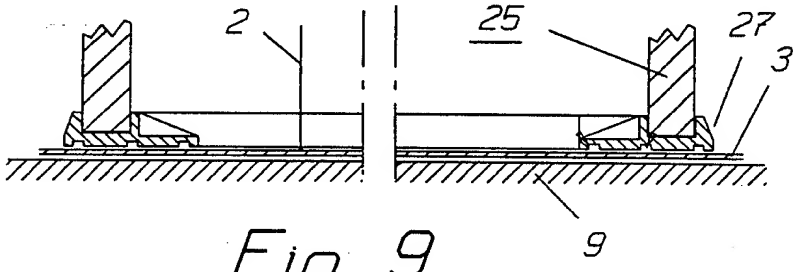

Fig. 9

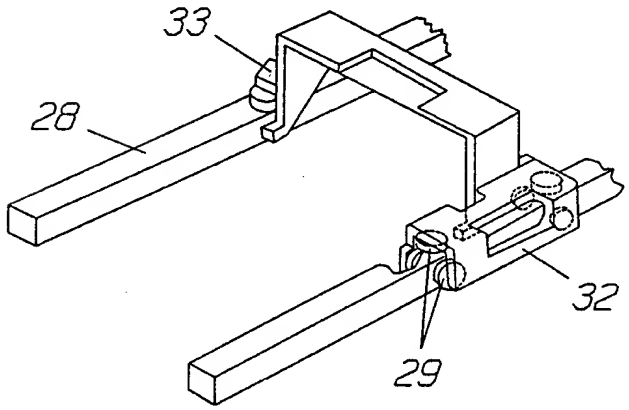

Fig. 10

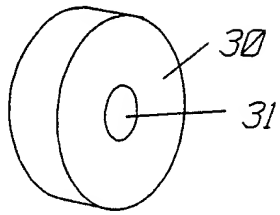

Fig. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 96/00564

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G03F 7/20, G03F 9/00, G03B 27/10, G03B 27/16, B41C 1/10
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B41C, G03B, G03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SE 9101619-6 A (MISOMEX AB), 29 November 1992 (29.11.92), page 2, line 5 - line 17; page 6, line 5 - line 18; page 8, line 4 - line 10, figures 3-5	1-3
A	US 5145756 A (W. WINDELN ET AL), 8 Sept 1992 (08.09.92), figure 1a, abstract	1-10
A	US 4821048 A (K-J HORNIG ET AL), 11 April 1989 (11.04.89), figure 4, abstract	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 August 1996	20 -08- 1996
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Bengt Christensson Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

31/07/96

International application No.
PCT/SE 96/00564

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE-A- 9101619-6	29/11/92	NONE	
US-A- 5145756	08/09/92	DE-A,C- 3734438	27/04/89
		EP-A- 0316207	17/05/89
		JP-A- 1154079	16/06/89
US-A- 4821048	11/04/89	DE-A- 3614645	05/11/87
		EP-A,B- 0243659	04/11/87